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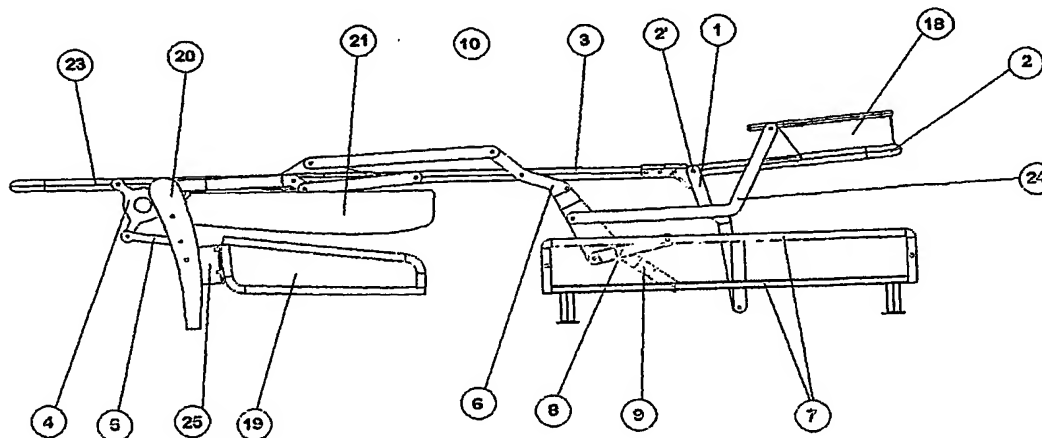
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(54) Title: **SOFA BED AND ITS OPEN-CLOSE MECHANISM**



(57) Abstract: Divan bed comprising an almost parallelepiped frame structure, a plurality of movable frames, each constrained and movable according to roto-translative motions from a closing to an opening position, wherein said frames in the closing position are sequentially folded one over the other, and in the opening position, are consecutively aligned, and a mechanism able to move said frames characterized in that the mechanism comprises at least one lever, hinged in the node between the frame (2), a headrest, and the adjacent frame (3). In this way, undesired closure of the divan bed cannot occur.

WO 2004/086913 A1

Title:       **Sofa bed and its open-close mechanism**

Applicant: **Gruppo Industriale Styling**

5    Technical field

The present invention relates to a sofa bed and its open-close mechanism. As known, a sofa bed comprises an almost parallelepiped frame structure, which forms an internal containment area for bedding storage, and a number of movable  
10 frames, bound together. These frames move according to roto-translating motions from the close to open position. In the close position, the frames fold up to keep the mattress folded in a number of pieces and stored in the area created by the fixed structure; in the open position, the movable frames are  
15 consecutively aligned, outside of said volume and define a rest surface. These movements are made possible thanks to one or more mechanisms interposed between the fixed structure and the movable frames.

Up to now, various types of similar mechanisms with at least  
20 three movable frames have been developed and many state-of-the-art mechanisms easily converts the sofa into a bed without having to remove any of the cushions. The present applicant has already described and claimed a similar product in the Italian patent application BA01A000005.

25 Despite the technical progress made, the known applications

show still several disadvantages. The largest limitation of the known mechanisms is the risk of accidental closing. In fact, when in bed position, should the user be seated close to the hinged joint between the frame (2) and the adjacent frame (3), both in Fig. 1, an accidental closing of the bed may occur.

#### Disclosure of the invention

The invention solves the technical problem identified above, because it is a sofa bed comprising an almost parallelepiped frame structure; a number of movable frames, bound together, that move according to roto-translating motions from the close to open position, wherein in the close position said frames are sequentially folded up, while in the open position, are consecutively aligned; and a mechanism that moves said frames, characterized in that the mechanism comprises at least one lever, hinged to the joint between the frame (2), said headrest, and the adjacent frame (3), preventing the lowering of the above mentioned joint. In this way, the problem of accidental closing of the bed has been solved.

According to a subsequent aim, the invention is capable of moving the seat cushion by means of only two additional elements.

Furthermore said mechanism has one degree of freedom only and open and closes in one movement without removing seat and back cushions (21) and (19).

These and other advantages will be pointed out in the detailed description of the invention that will refer to the figures of tables 1/2 and 2/2 in which an exemplifying and not restrictive embodiment of the invention has been carried out.

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#### Way of carrying out the invention

With reference to the above mentioned tables:

- Fig. 1 shows the sofa-bed structure in the “bed” position;
- Fig. 2 shows an axonometric view of the same sofa bed;
- 10 • Figs 3, 4 and 5 show three consecutive steps of the sofa bed open operation;
- Finally, Fig. 6 shows a detail of the frame in the “bed” position.

With reference to the previous figures, the mafore-entioned goals  
15 were met thanks to a sofa bed comprising a driving mechanism, positioned between each/a frame and the following one. Said mechanism has synchronization tools to move the movable frames from the close to open position, and viceversa, in one movement only.

20 The sofa bed (Fig. 2) is identified with the number/reference (11), while the fixed structure with (7). The frame structure has an almost parallelepiped shaped, which forms an internal containment area and is composed of several frames. Among such frames, at least one acts as a support for the back cushions.

25 The fixed structure (7) defines an internal containment area (14),

inside which the movable frames, bound one with the other, fold up to convert the sofa bed in the sitting position. Then, said movable frames can switch from close to open position (see the sequence in Figs. 3, 4 and 5), provided that they are aligned, forming a rest surface, numbered with (15).

The present mechanism, numbered with (10), comprises synchronization tools, interposed between the movable frames, to move the frames from the close to open position (see again the sequence in Figs. 3, 4 and 5), and viceversa, in one movement. It comprises a quadrilateral (16), a quadrilateral (12) and a quadrilateral (17). The lifting and opening system of said mechanism is provided by the quadrilaterals (16) and (12), and by springs (not shown in the figures) to facilitate the operation.

In particular, a first retain elastic mean is interposed between the lever (6) and the lever (1), while between the lever (1) and the fixed structure (7) is interposed a second retain elastic mean. Said elastic means can also be positioned on those elements fastened to elements (6), (2) and (7). The quadrilateral (12) provides the headrest (2) in the bed configuration, while, in the sitting configuration, said headrest is vertical. The quadrilateral (16) moves synchronically the rest of the mechanism by means of levers (8) and (9) hinged to the fixed structure (7). As an alternative to it, the lifting of said mechanism can also be obtained by means of two simple quadrilaterals (not shown in the figures), one end of each one is hinged to the fixed structure (7),

and the other end is hinged to the frame (2). The two quadrilaterals are joined together by means of a lever, which makes synchronous their motion. Said quadrilaterals determine the vertical translation of the frame (2), from bottom up during the opening, from top down during the closing.

Finally, the quadrilateral (17), shown in Fig. 6, comprising the levers (4), (5), part of lever (25) and part of lever (23), moves the sliding system of the seat cushions (21).

Beside the conversion from sofa to bed, and viceversa, the mechanism has been also designed to perform a particular trajectory. Following this trajectory the mechanism reaches a height above the ground that makes itself manageable, as one can see in Fig. 4. The strong point of this new mechanism is (Fig. 1) the fact that the lever (1) is hinged in the joint (2') between the headrest frame (2) and the central frame (3). From a functional point of view, it solves the problem of accidental closing of the bed. In fact, in known mechanisms, the lever (1) is hinged on the headrest frame (2); consequently, accidental closing may occur when the user is seated close to the hinged joint (2') between the headrest frame (2) and the adjacent frame (3). Another strong point of this mechanism is the movement of the seat cushions (21) by means of only two additional elements. The addition of elements (4) and (5) creates an easy system based on an articulated quadrilateral (17). An additional feature of the mechanism is that the lever (6) can have five holes (as in

the embodiment of Fig. 1), or four holes can be bolted directly to the fixed structure (7). In the case of a 5-hole lever, the lever (6) being hinged to the levers (8) and (9) performs a roto-translation. In the four holes configuration, the lever (6), instead of roto-translating, can rotate around a point fixed with respect to the  
5 fixed structure (7). This means the elimination of the levers (8) and (9).

### Claims

- 1) Sofa bed comprising an almost parallelepiped frame structure; a number of movable frames, bound together, that move according to roto-translating motions from the close to open position, wherein in the closing position said frames are sequentially folded up, while in the open position, are consecutively aligned; and a mechanism that moves said frames, characterized in that it comprises at least one lever, hinged to the joint between the frame (2), said headrest, and the adjacent frame (3).
- 2) Mechanism for sofa bed and similar products, comprising a number of articulated quadrilaterals and synchronization tools and characterised by the fact that at least one lever has an end hinged to the joint (2') between the frame (2), said headrest, and the adjacent frame (3); while the other lever end is directly hinged to the fixed structure or to any element fastened to said fixed structure.
- 3) Mechanism according to claim 2 characterized by the fact that said mechanism comprises quadrilateral (16), quadrilateral (12) and quadrilateral (17).
- 4) Mechanism according to claims 2 or 3, characterized by the fact that a first retain elastic mean is interposed between the lever (6) and the lever (1), while between the lever (1) and the fixed structure (7) is interposed a second retain elastic mean.



- 5) Mechanism according to claim 4, characterized by the fact that said elastic means can also be positioned on the elements bound to elements (6), (2) and (7).
- 5 6) Mechanism according to at least one of the claims from 3 to 5, characterized by the fact that said quadrilateral (12) determines the position of the headrest (2) in the bed configuration, being the headrest in vertical position in the sofa configuration.
- 10 7) Mechanism according to claim 2, characterized by the fact that the lifting can be obtained by means of two simple quadrilaterals; said quadrilaterals have one end hinged at the fixed structure (7), the other end at the frame (2) and are joined each other by means of a lever, which makes synchronous their motion.
- 15 8) Mechanism according to at least one of the claims from 3 to 7, characterized by the fact that said quadrilateral (16) moves synchronically the rest of the mechanism.
- 20 9) Mechanism according to claim 8, characterized by the fact that said quadrilateral (16) comprises a 5-hole lever (6), hinged to the levers (8) and (9), having roto-translative motion.
- 25 10) Mechanism according to claim 8, characterized by the fact that said quadrilateral (16) comprises a 4-hole lever (6), directly hinged to the fixed structure (7), with rotatory motion around a point fixed with respect to the fixed

structure (7).

11) Mechanism according to at least one of the claims from 3 to 10, characterized by the fact that said mechanism performs a particular path, which raises the mechanism to a height above the ground that makes the mechanism manageable.

12) Mechanism according to at least one of the claims from 3 to 11, characterized by the fact that said quadrilateral (17) moves the sliding system of the seat cushions (21).

13) Mechanism according to the claim 12, characterized by the fact that said quadrilateral (17) moves the seat cushion (21) by means of only two additional elements (4) and (5).

14) Mechanism according to claim 13, characterized by the fact that said lever (4) has at least three holes, one of them hinges a frame, upon which the seat cushions (21) are placed.

**AMENDED CLAIMS**

[received by the International Bureau on 21 July 2004 (21.07.2004);  
original claims 1-14 replaced by new claims 1-13 (3 pages)]

**Claims**

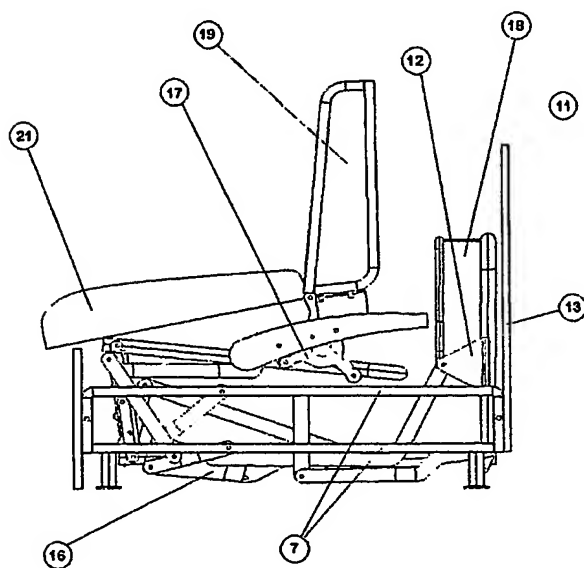
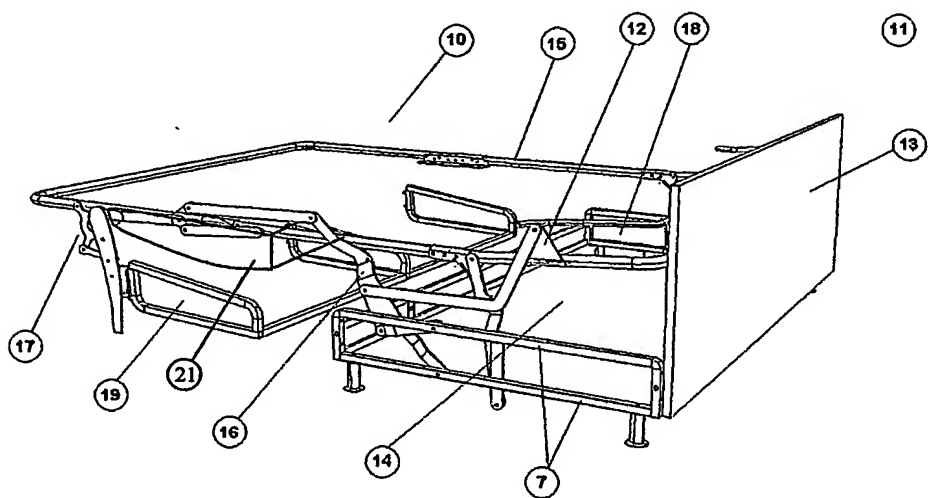
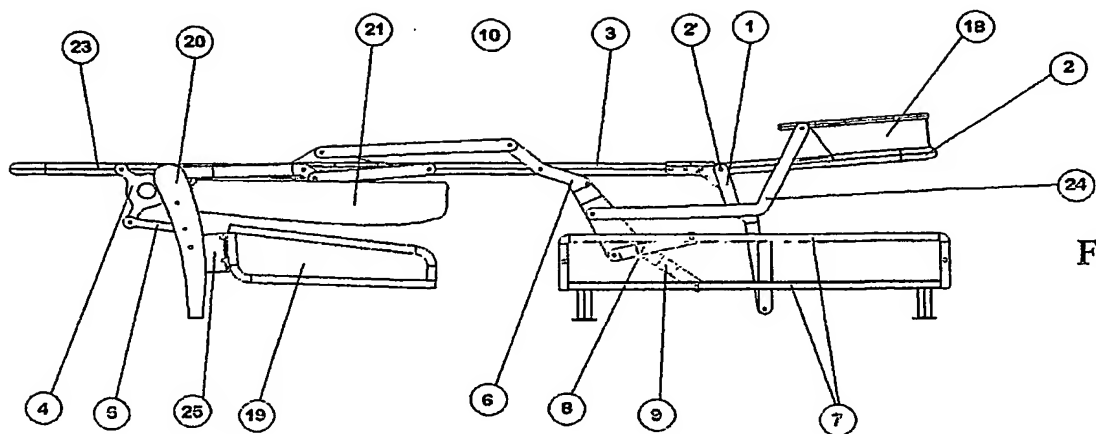
- 1) Mechanism for sofa bed and similar products, comprising a number of articulated quadrilaterals and synchronization tools, with at least one lever having an end hinged to the joint (2') between the frame (2), the headrest, and the adjacent frame (3); and characterized by the fact that said mechanism comprises a quadrilateral (16), a quadrilateral (12) and a quadrilateral (17).
- 2) Mechanism according to claims 1, characterized by the fact that a first retain elastic mean is interposed between the lever (6) and the lever (1), while between the lever (1) and the fixed structure (7) is interposed a second retain elastic mean.
- 3) Mechanism according to claim 2, characterized by the fact that said elastic means can also be positioned on the elements bound to elements (6), (2) and (7).
- 4) Mechanism according to at least one of the claims from 1 to 3, characterized by the fact that said quadrilateral (12) determines the position of the headrest (2) in the bed configuration, being the headrest in vertical position in the sofa configuration.
- 5) Mechanism according to claim 1, characterized by the fact that the lifting can be obtained by means of two simple quadrilaterals; said quadrilaterals have one end hinged at the fixed structure (7), the other end at the frame (2) and are joined each other by means of a lever, which makes synchronous their motion.

**AMENDED SHEET (ARTICLE 19)**

- 6) Mechanism according to at least one of the claims from 1 to 5, characterized by the fact that said quadrilateral (16) moves synchronically the rest of the mechanism.
- 7) Mechanism according to claim 6, characterized by the fact that said quadrilateral (16) comprises a 5-hole lever (6), hinged to the levers (8) and (9), having roto-translative motion.
- 8) Mechanism according to claim 6, characterized by the fact that said quadrilateral (16) comprises a 4-hole lever (6), directly hinged to the fixed structure (7), with rotatory motion around a point fixed with respect to the fixed structure (7).
- 9) Mechanism according to at least one of the claims from 1 to 8, characterized by the fact that said mechanism performs a particular path, which raises the mechanism to a height above the ground that makes the mechanism manageable.
- 10) Mechanism according to at least one of the claims from 1 to 9, characterized by the fact that said quadrilateral (17) moves the sliding system of the seat cushions (21).
- 11) Mechanism according to the claim 10, characterized by the fact that said quadrilateral (17) moves the seat cushion (21) by means of only two additional elements (4) and (5).
- 12) Mechanism according to claim 11, characterized by the fact that said lever (4) has at least three holes, one of them hinges a frame, upon which the seat cushions (21) are placed.
- 13) Sofa bed comprising an almost parallelepiped frame structure; a number of movable frames, bound together, that move according to roto-translating motions from the close to

open position, wherein in the closing position said frames are sequentially folded up, while in the open position, are consecutively aligned, characterized in that it uses a mechanism according to at least one of the previous claims.

AMENDED SHEET (ARTICLE 19)



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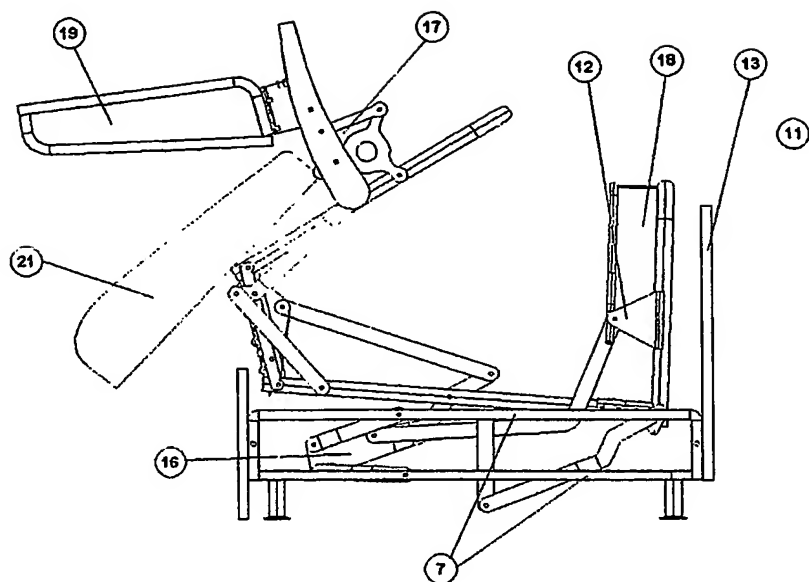


Fig. 4

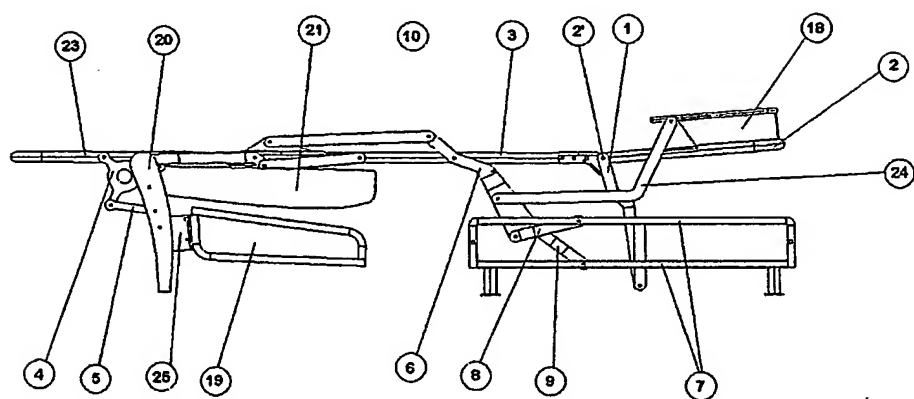


Fig. 5

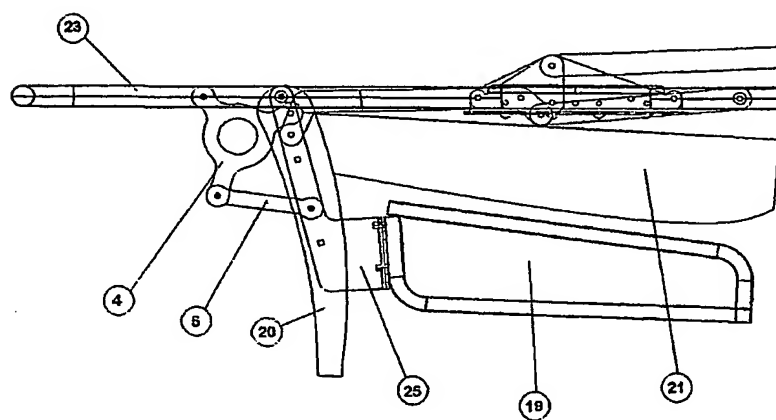


Fig. 6

# INTERNATIONAL SEARCH REPORT

Inte:      nal Application No  
PCT/IB2004/000568

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC 7      A47C17/22		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b>		
Minimum documentation searched (classification system followed by classification symbols) IPC 7      A47C		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, WPI Data		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 868 870 A (STEMA S R L) 7 October 1998 (1998-10-07) column 2, line 15 -column 5, line 3; figures 1-3	1-3,6-8, 11
X	EP 1 190 649 A (STEMA S R L) 27 March 2002 (2002-03-27) column 1, line 33 -column 1, line 47 column 2, line 52 -column 3, line 41; figures 1-8	1-3,6-8, 11
A	WO 98/44829 A (LOIUDICE GIUSEPPE) 15 October 1998 (1998-10-15) abstract; figures	1-14
A	US 4 780 918 A (HARTLINE MICHAEL F) 1 November 1988 (1988-11-01) abstract; figures	1-14
<div style="display: flex; justify-content: space-between;"> <span><input type="checkbox"/> Further documents are listed in the continuation of box C.</span> <span><input checked="" type="checkbox"/> Patent family members are listed in annex.</span> </div>		
<div style="display: flex;"> <div style="flex: 1;"> <p>* Special categories of cited documents :</p> <p>*A* document defining the general state of the art which is not considered to be of particular relevance</p> <p>*E* earlier document but published on or after the international filing date</p> <p>*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>*O* document referring to an oral disclosure, use, exhibition or other means</p> <p>*P* document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="flex: 1;"> <p>*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>* &amp; * document member of the same patent family</p> </div> </div>		
Date of the actual completion of the international search  <div style="text-align: center; font-weight: bold;">27 May 2004</div>		Date of mailing of the international search report  <div style="text-align: center; font-weight: bold;">23/06/2004</div>
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer  <div style="text-align: center; font-weight: bold;">MacCormick, D</div>



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